Patterns of Transport Partitioning in the Nearshore

Daniel C. Conley
Marine Sciences Research Center
State University of New York, Stony Brook
Stony Brook, NY 11794-5000
phone: (631) 632-9251 fax: (631) 632-8820 email: daniel.conley@sunysb.edu

Award Number: N00014-98-1-0007
http://www.msrc.sunysb.edu/pages/faculty_prof/conley.html

LONG-TERM GOALS

The ultimate goal of this research is to determine what are the relevant sediment mobilization and transport processes at play on the beach that must be included in numerical models of nearshore bathymetric evolution.

OBJECTIVES

The primary objective for this year was the continued analysis of the data from the "FLUID-SEDIMENT INTERACTIONS IN THE NEARSHORE" experiment at SandyDuck97. In particular, this data was to be examined to understand the behavior of different spectral components of the total sediment transport signal as a function of, incident wave conditions, position within the surfzone, and vertical location.

APPROACH

Vertical profiles of fluid velocity and sediment concentration at 9 locations in the surf zone are analyzed to provide time series of the sediment transport signal in the lower half of the water column. This signal is partitioned into several spectral bands that represent the mean transport component and the incident and infragravity components of transport. This information is examined to identify the relative importance of these components as a function of surf-zone location and fluid forcing as well as to determine the importance of the divergence of these components on morphologic evolution.

WORK COMPLETED

Weeks 41 and 42 of the Sandy Duck experiment have now been fully processed to identify valid periods of observation and to locate the sediment bed during those periods. Detailed analysis of the data collected during the storm event spanning the period 18 Oct. -20 Oct. has been completed and a publication discussing this analysis has been prepared.

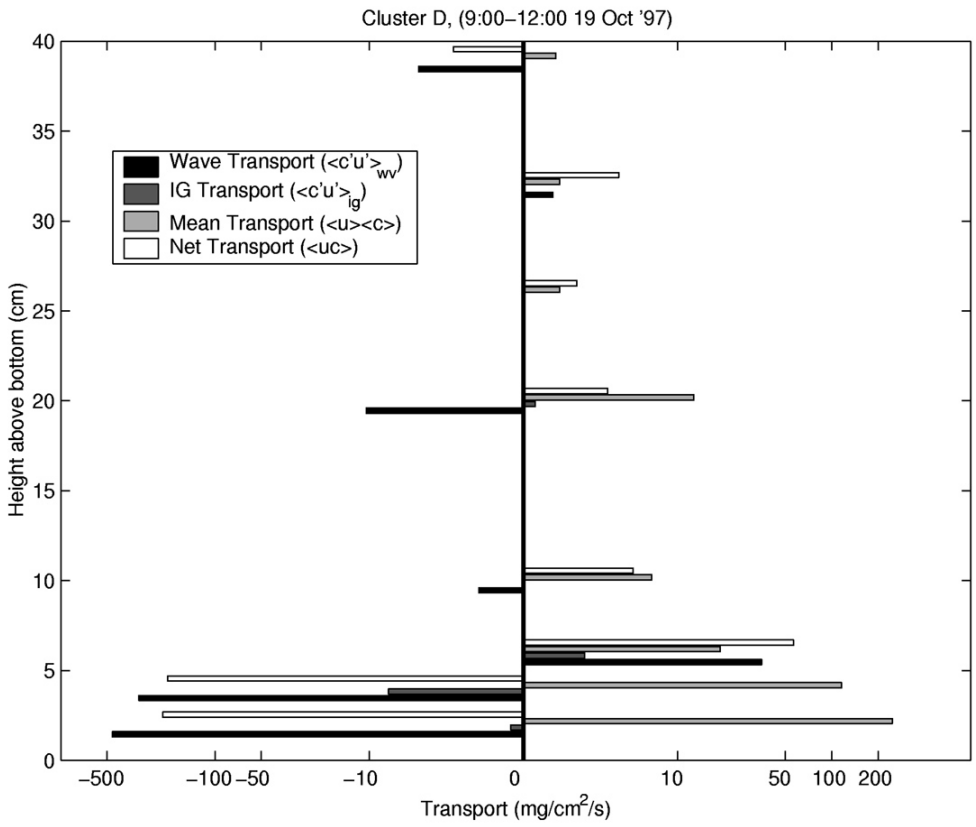

Figure 1. Flag plot indicating the vertical distribution of various spectral components of transport for one run at Cluster D. Values represent averages of all valid sub-runs at each elevation. This figure shows the change in direction of net transport with elevation that can occur due to the increasing importance of wave coherent transport near the bottom. Note that the transport scale is logarithmic based. For this reason, all values with magnitude less than 1 have been ignored.

RESULTS

Major findings of the present work include:

- At this location, net cross-shore sediment transport generally represents a sensitive balance between an offshore directed mean transport and an onshore directed wave coherent transport.

- The infra-gravity component appears relatively unimportant.

- The relative importance of the wave coherent transport increases as the bottom is approached. This pattern can lead to a reversal in the direction of net transport with height above the bed (Figure 1).

- The magnitude of the normalized wave coherent transport appears to be significantly correlated with a parameter that measures the relative strength of the wave half-cycle asymmetry in sediment threshold-velocity exceedance.

While the first two results have been partially observed at other locations, the third observation (Figure 1) has not been previously reported in the literature. It has been observed that net depth-integrated transport can be onshore even in the presence of net offshore transport at individual levels removed from the bed. The final result begins to point the way towards an independent parameterization of the wave coherent transport.

IMPACT/APPLICATIONS

The significance of these observations is multifold. From an observational point of view, these results suggest single point observations of sediment transport, or even multi-point observations removed from the bed may be misleading. Estimates of net transport from this type of observation may be in error not only in magnitude but also in direction. The present results, which are analyzed only as low as 1 cm above the at-rest seabed, also seem to indicate that a significant and perhaps most important contribution to the total transport signal comes from transport near or below the at-rest bed. As relates to modeling efforts, the results clearly confirm that simulations of nearshore transport must include the wave coherent transport as well as the mean transport. These results suggest that in the present location and conditions, the infra-gravity contribution to transport may not be significant. It is clear that transport simulations must, in some fashion, account for the total vertical distribution of transport. Finally, the observations suggest that the wave coherent transport may be parameterized by a measure of asymmetry in wave threshold-velocity exceedance.

TRANSITIONS

Upon the completion of a parameter based model for the prediction of the wave coherent transport, the model will be used in a quasi-3D nearshore bathymetric evolution modeling effort funded by New York Sea Grant.

RELATED PROJECTS

NA

PUBLICATIONS

Conley, D.C., Beach, R. Cross-shore Sediment Transport Partitioning in the Nearshore during a Storm Event. Submitted to *Journal of Geophysical Research*.